

UTILITY PATENT APPLICATION TRANSMITTAL UNDER 37 C.F.R. §1.53(b)

ASSISTANT COMMISSIONER FOR PATENTS

PATENT APPLICATION

Washington D.C. 20231

Case Docket No.: P-056

Submitted herewith for filing is the patent application of

INVENTOR OR APPLICATION IDENTIFIER: Joong-Kyu CHOI

FOR: DATABASE SYNCHRONIZATION APPARATUS IN ELEMENT MANAGEMENT SYSTEM AND METHOD THEREFOR

Enclosed are:

1. [X] 17 pages of specification, claims, abstract

2. [X] 5 sheets of FORMAL drawing.

3. [X] 2 pages of newly executed Declaration & Power of Attorney (original).

4. [X] Priority Claimed.

5. [] Small Entity Statement.

6. [] Information Disclosure Statement, Form PTO-1449 and reference.

10. [X] Authorization under 37 C.F.R. §1.136(a)(3).

11. [X] Other: Preliminary Amendment

7. [X] Assignment Papers for LG Information & Communications, Ltd.

(cover sheet, assignment & assignment fee).

8. [X] Certified copy of Korean Patent Application No. 58802/1998, filed December 26, 1998.

9. [X] Two (2) return postcards.

[X] Stamp & Return with Courier.

[X] Prepaid Postcard-Stamped Filing Date & Returned with Unofficial Serial Number.

For	No. Filed		No. Extra	Rate	Fee
Total Claims	18	- 20	0	X \$18.00	\$0.00
Indep. Claims	2	- 3	0	X \$78.00	\$0.00
Multiple Dependent Claims (If applicable)				X \$260.00	\$0.00
				BASIC FEE	\$760.00
				TOTAL FILING FEE	\$760.00

[] This is a Continuation-in-part (CIP) of prior application No: _____ filed _____. Incorporation By Reference-The entire disclosure of the prior application is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

[] Amend the specification by inserting before the first line the sentence:

-This application is a continuation-in-part of Application Serial No. _____ filed _____.-

[X] A check in the amount of \$760.00 (Check #8073) is attached.

[] Please charge my Deposit Account No. 16-0607 in the amount of \$ _____. A duplicate copy of this sheet is enclosed.

[X] The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 16-0607. A duplicate copy is enclosed.

[X] Any additional filing fees required under 37 C.F.R. 1.16.

[X] The Commissioner is hereby authorized to charge payment of following fees during the pendency of this application or credit any overpayment to Deposit Account No. 16-0607. A duplicate copy of this sheet is enclosed.

[X] Any patent application processing fees under 37 C.F.R. 1.17.

[X] Any filing fees under 37 C.F.R. 1.16 for presentation of extra claims.

FLESHNER & KIM

Carl R. Wesolowski

Daniel Y.J. Kim

Registration No. 36,186

Carl R. Wesolowski

Registration No. 40,372

* Correspondence Address Below:

P.O. Box 221200

Chantilly, VA 20153-1200

(703) 502-9440

Date: December 22, 1999

Docket No.: P-056

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :

Joong-Kyu CHOI :

New U.S. Patent Application :

Filed: December 22, 1999 :

For: DATABASE SYNCHRONIZATION APPARATUS IN ELEMENT
MANAGEMENT SYSTEM AND METHOD THEREFOR

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D. C. 20231

Sir:

Prior to initial examination on the merits, please amend the above-identified
application as follows:

IN THE CLAIMS:

Please amend claims 16-19 as follows:

Claim 16, line 1, change "16." to -15.-.

Claim 17, line 1, change "17." to -16.-; and
line 2, change "16," to -15,-.

Claim 18, line 1, change "18." to --17.--; and
line 2, change "16," to --15,--.

Claim 19, line 1, change "19." to --18.--; and
line 2, change "17," to --16,--.

REMARKS

Claims 1-18 are pending. Claims 16-19 have been amended to correct the numbering of the claims. Prompt examination and allowance in due course are respectfully solicited.

Respectfully submitted,
FLESHNER & KIM



Daniel Y.J. Kim
Registration No. 36,186
Carl R. Wesolowski
Registration No. 40,372

P.O. Box 221200
Chantilly, VA 20153-1200
703 502-9440 DYK/CRW:jld
Date: December 22, 1999

DATABASE SYNCHRONIZATION APPARATUS IN ELEMENT MANAGEMENT SYSTEM AND METHOD THEREFOR.

BACKGROUND OF THE INVENTION

5

1. Field of the Invention

The present invention relates to an EMS(Element Management System) and, in particular, to a method for a database synchronization between an EMS and NEs(Network Elements).

10

2. Description of the Prior Art

Generally, in a transmission network system, since a network element management system processes a real-time data, a status of a network element(hereinafter referred to as NE) must be analyzed accurately and rapidly for thereby reporting to the network element management system.

15

Figure 1 is a view illustrating a network EMS(hereinafter referred to as EMS) and network elements in the conventional art.

As shown in Figure 1, each of the NEs has its NE_DataBase(hereinafter referred to as NE_DB). In the case that a data such as a DB, DB information, alarm state information, etc. is modified, the NE reports its changed status to the EMS, and the EMS performs a network management using a newly reported data.

20

As described above, the process in which each of the NEs reports its DB, DB information, alarm state information, etc. to the EMS, and, as a result, each NE and the EMS have the same information, is referred to as an identity maintaining process. The process in which the modified data is detected by the EMS at a

25

certain time (period) T, and thereby a network management is performed using a modified database, is referred to as a synchronization.

There are two methods of maintaining the identity of the DB. One is a method in which the EMS periodically demands a synchronization from the NEs.

- 5 The other is a method in which the NEs automatically report their modifications when the NEs are modified.

However, the former method has a disadvantage that since the EMS demands that each NE reports its modified DB by item and by pattern, the initialization process for synchronization between the EMS and each NE is
10 lengthened. Accordingly, there arises a problem that it is difficult to apply the modified DB generated between the EMS and the NEs to the EMS accurately and rapidly.

In addition, the latter method is a method in which each NE reports its modifications to the EMS whenever its DB is modified. There is a possibility of a
15 trade-off between a reporting period(T) and sync-related data. Therefore, when the reporting period is shortened, the amount of traffic is increased. On the contrary, when the reporting period is lengthened, the amount of sync-related data is increased, making it difficult to apply a real-time data.

20 SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a method for synchronization between an EMS and a NE which facilitates a real-time DB monitoring and management by transmitting the status information of a modified
25 NE.

09469307-12299

To achieve the above object, the present invention, in a DB synchronization apparatus of a transmission network system which includes a plurality of NEs and a EMS, comprises the NEs each of which includes a common memory in which DB information and alarm state information are rearranged; and a sync-related
5 memory of the same pattern as the common memory for maintaining DB identity with the EMS, and the EMS which includes a EMS sync-related memory for storing the DB and the information of the sync-related memory of the plurality of NEs, and a EMS common memory corresponding to the common memory of the NE.

10 In addition, in a method for DB synchronization in a transmission network which includes a plurality of NEs and a EMS, the NE compares the current status memory (common memory) with the previous status memory (related memory) in block unit, and transmit the position and information of a modified block to the EMS and copy the same for thereby applying DB synchronization periodically.

15 Additional advantages, objects and features of the invention will become more apparent from the description which follows.

BRIEF DESCRIPTION OF THE INVENTION.

20 The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Figure 1 is a block diagram of a communication network of a EMS and NEs
25 in a general transmission network;

Figure 2 is a block diagram of a communication network of a WDCS_EMS and WDCS_NEs according to the present invention;

Figure 3 illustrates a data pattern for a data synchronization in the present invention;

5 Figure 4 is a flow chart illustrating a method for a synchronization between a EMS and NEs according to the present invention;

Figure 5 is a flow chart illustrating a periodical reporting process according to the present invention;

10 Figure 6 is a flow chart illustrating a resynchronization process according to the present invention;

Figure 7 is a view illustrating a comparison between a transmission block according to the present invention and a conventional transmission cell.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS.

15 Preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

Figure 2 is a block diagram of a communication network of a WDCS_EMS and WDCS_NEs according to the present invention and, in particular, a block
20 diagram of a communication network of a EMS and NEs in a transmission network of a plurality of wide distribution control system network elements (hereinafter referred to as NE) 120~12n and a wide distribution control system element management system (hereinafter referred to as EMS) 100 which operates and manages NEs. A EMS and a N number of NEs are connected through a
25 communication link 112 of the same pattern as a packet network.

Each of the NEs is comprised of the same DB 130~13n as the conventional methods, a common memory (hereinafter referred to as NE_CM) 150~15n in which DB information and alarm state information according to the present invention are rearranged, a sync-related memory (hereinafter referred to as NE_RM) 140~14n which is a memory of the same pattern as the NE_CM 150~15n for maintaining DB identity with the EMS

In addition, the EMS 100 is comprised of a EMS_RM 103 which stores the same DB as the conventional methods, the RM 140 information of each NE, and a EMS_CM 102 corresponding to the CM of the NEs.

Figure 3 illustrates a data format according to the present invention. After comparing a NE_CM 150~15n and a NE_RM 140~14n in block unit, a series of data can be divided into a header bit which stores the sequence (i) of the corresponding block If NE_CM data and NE_RM data are not identical, a EndFlag bit which indicates 1 if a transmitted data is the last block, or which indicates 0 if a transmitted data is not the last block, and a data bit in which a real transmitted data is contained.

The embodiment of Figure 2 can be described as follows in more detail with reference to Figure 3. As a result of the comparison between the NE_CM and the NE_RM in block unit, if it is found that there is a block changed, the number (i) of the corresponding block is written on the header of data which will be transmitted for thereby transmitting the same to the RM of the EMS, and NE_CM data is copied into the NE_RM to thus store the current status of the NEs in the NE_RM.

By the above procedure, when the EMS succeeds in receiving a modified data from each NE, the received data is stored in the RM of the EMS in accordance with the corresponding header. When the EMS fails to receive the

modified data, the next modified data is received after increasing the cell block counter, and the modified data that has failed to be received is received in the next period. In this manner, the RM of the EMS is copied into the CM of the EMS for thereby reflecting the current status immediately.

- 5 Moreover, when a network operation manager selects a certain NE in the EMS, the EMS_RM is copied into the EMS_CM, so that the status of the corresponding NE is monitored immediately.

As described above, according to the present invention, changes of the NEs can be rapidly found by comparing the sync-related memory and the common
10 memory. The more the amount of database change is, the smaller amount of data blocks are transmitted, thereby obtaining a database synchronization: Therefore, database changes are applicable to the EMS within a short time, and a real-time data monitoring and management becomes easier.

The operational procedure according to the present invention can be divide
15 into a first step of initialization, a second step of periodical reporting, a third step of resynchronization, and a fourth step of manual synchronization.

The first step of initialization will be described below with reference to Figure 4.

First, when the system of the NEs is driven in step S301, the NE_CM is
20 configured according to the DB information and the current alarm state, and, at the same time, the NR_RM waits a synchronization request signal (SYNC_REQ) or a resynchronization request signal (RESYNC_REQ) from the EMS after the initialization in step S302.

Meanwhile, when the EMS system is driven, a SYNC_REQ signal is
25 transmitted to all of the NEs in step S303. Each NE that has received this signal

sends a synchronization acknowledgement (SYNC_ACK) to the EMS in step S304. The EMS prepares a sync-related data for storing the same to the EMS_RM after receiving the SYNC_ACK.

The NE which has received the SYNC_ACK compares the NE_RM and the NE_CM in data block unit in step S305. If both data are not identical, the position and data of the corresponding block is transmitted in the data format of Figure 3 in step S307. If the transmission succeeds in step S308, the corresponding block (i) of the NE_CM is copied into the corresponding block (i) of the NE_RM in step S309. Steps S301 through S309 of the flow chart are executed on all of the NEs. The above procedure is performed in block unit in step S311. When the data transmission of the last block in step S310 succeeds, the database synchronization between the EMS and the NEs is finished in step S400, and thereafter the periodical reporting step is performed.

The second step of periodical reporting, as illustrated in Figure 5, will be described as follows.

Once the initialization is finished as illustrated in Figure 4, both data in the RM of the EMS and the RM of the NE, respectively, become identical. Subsequently, when an internal timer is driven in step S401 for a periodical reporting to thereafter start a T-second period in step S402, the NE_CM and NE_RM of the NE are compared each other in block unit in steps S404 and S405.

As a result of the comparison, in the case that two blocks at both sides are different, that is, data is changed, the position and data of the corresponding block is transmitted to the EMS in step S406. If the transmission succeeds in step S407, the corresponding block of the NE_CM is copied into the corresponding block of the NE_RM in step S408. At the same time, the EMS receives the

corresponding data for thereby copying the same into the EMS_RM. The above comparison based on the block unit continues to the last block in step S403, and the procedure for one period T is ended after transmitting the last block.

If there is no modified data during a certain period T, the last block of the
5 NE_RM is transmitted to the EMS in step S409, and the EMS finishes the procedure for one period after receiving the last block of the NE_RM.

The third step of resynchronization, as illustrated in Figure 6, will be described as follows.

In the case that the NE transmits a sync-related data to the EMS at T-
10 second periods, the NE must transmit the last block of the NE_RM even though there is no change for T-seconds.

That is, the EMS has to receive a sync-related data more than once from an arbitrary NE within a T-second period. However, if the NE system is down, or there occurs a error in a link path, the EMS is unable to receive a sync-related data from
15 the NEs within a T-second period.

As illustrated in Figure 6, if the EMS has failed to receive any sync-related data within a T-second period more than three times, a resynchronization request (RESYNC_REQ) signal is transmitted to the NEs in step S503, when a sync-related data is received as a result of the resynchronization request, the routine
20 returns to step S402 of Figure 5.

For instance, in the case that the NE system is down, and then up, an acknowledgement to the RESYNC_REQ is transmitted to the EMS to thereafter execute the initialization step, as illustrated in Figure 4, again.

In addition, in the case that a link error occurs and then, is recovered, if a
25 RESYNC_REQ is received from the EMS to the NEs, an acknowledgement to the

RESYNC_REQ is transmitted to the EMS, then both data in the NE_CM and NE_RM are compared, and then data which is modified during the error is transmitted to the EMS.

The resynchronization step is performed aperiodically (aperiodically eight
5 times for 30 minutes) for a certain time after the error occurrence. In the case that the error is not recovered even after the above resynchronization step, the routine passe to the manual synchronization step.

The manual synchronization step is executed because it is more effective that a network operation manager performs synchronization manually in order to
10 prevent overload on the system and links, in the case that the error is not recovered even after the resynchronization step. The manual synchronization step will be described below.

In the case that a link error between the EMS and the NEs continues for a certain time(more than 30 minutes), the automatic resynchronization step is
15 stopped to thereafter pass to the manual synchronization step in which an operator performs synchronization manually.

The network operator determines whether the corresponding NE or link error is recovered, and manually performs a synchronization instruction on the menu. In the case that the error is not recovered, the error state does not change.
20 When the manual synchronization succeeds, the NEs transmit a sync-related data to the EMS to thereafter switch back to the periodical reporting state.

As described above, the present invention provides the NEs with the NE_CM which contains DB information as well as the current alarm state, and the NE_RM which stores data prior to a T-second period. Thereafter, both memories
25 are compared for thereby transferring data to the network element management

system rapidly and accurately. In addition, as illustrated in Figure 7, in the case that changes in databases in both memories are concentrated in a certain particular block, a small amount of data blocks are transmitted to thus establish an effective database synchronization. Accordingly, there is the advantages that a
5 real-time data monitoring and management is possible, initialization time is fast, and an effective database synchronization can be established.

Although the preferred embodiment of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing
10 from the scope and spirit of the invention as recited in the accompanying claims.

00469307-122293

What is claimed is:

1. An apparatus for database synchronization in a network element management system, comprising:

5 at least one or more network elements which compare a common memory, the current status memory, and a sync-related memory, the previous status memory, in block units for thereby transmitting the results of the comparison; and
a network element management system which stores data transmitted from the network elements for thereby monitoring and managing the network elements
10 in real time.

2. The apparatus for database synchronization in a network element management system of claim 1, wherein, in said at least one or more network elements, said common memory, the current status memory, and said sync-related
15 memory, the previous status memory, are connected each other for thereby comparing both memories periodically.

3. The apparatus for database synchronization in a network element management system of claim 1, wherein said network elements each have their
20 databases.

4. The apparatus for database synchronization in a network element management system of claim 1, wherein said network element management system has a sync-related memory for storing changes in memory which are the
25 results of the comparison between memories of said network elements.

5. The apparatus for database synchronization in a network element management system of claim 1, wherein said network element management system has a common memory which is connected with said sync-related system to thereby store the current network status.

6. The apparatus for database synchronization in a network element management system of claim 1, wherein said network element management system has its database.

7. The apparatus for database synchronization in a network element management system of claim 1, wherein a transmitted data includes:

a header bit which indicates the block partitioning sequencing of the entire memory;

a EndFlag bit which indicates the last block; and

a data bit which indicates a real data of each block.

8. In a network element management system which is provided with at least one or more network elements, a method for database synchronization in a network element management system, comprising the steps of:

comparing a common memory which reflects database information, the current alarm state, etc. of said network elements, and a sync-related memory which stores data prior to a certain period, in block units;

transmitting only modified block data, as a result of said comparison, to said network element management system; and

storing said transmitted data in the memory of the network element

management system.

9. The method for database synchronization in a network element management system of claim 8, wherein said step of comparing two memories in
5 block units includes an initialization step in which initial values of memories are set according to database information and alarm information, and a synchronization request is waited for.

10. The method for database synchronization in a network element management system of claim 9, wherein said initialization step includes:

a step in which at least one or more network elements initialize a common memory according to their database information and alarm information;

a step of initializing said common memory and a sync-related memory at the same time; and

15 a step of waiting a SYNC_REQ signal from said network element management system.

11. The method for database synchronization in a network element management system of claim 9, wherein said step of transmitting said modified
20 data to said network element management system includes:

a step of transmitting the position and data of the corresponding block when both data in said common memory and said sync-related memory are not identical;

a step of copying the corresponding block of the common memory in said
25 network element management system into the corresponding block of the sync-

related data; and

a step of comparing the next block again when said both data are identical.

12. The method for database synchronization in a network element
5 management system of claim 11, wherein said step of transmitting said modified
data to said network element management system further includes a step of not
copying the corresponding block of the common memory in said network element
management system into the corresponding block of the sync-related data, in the
case that a transmission of the modified data to the network element management
10 system has failed.

13. The method for database synchronization in a network element
management system of claim 8, wherein said transmitted data includes:

a header bit which indicates the block partitioning sequencing of the entire
15 memory;
an EndFlag bit which indicates the last block; and
a data bit which indicates a real data of each block.

14. The method for database synchronization in a network element
20 management system of claim 8, wherein said step of comparing said two
memories in block units further includes:

a step of transmitting the last block of said network elements to said
network element management system, in the case that there is no change in
blocks.

25

16. The method for database synchronization in a network element management system of claim 8, wherein said step of comparing said two memories in block units further includes:

a resynchronization step of setting initial values of the memories according to said database information and said alarm information, and synchronizing said values, in the case that said network element management system continues not receiving signals from said network elements more than a certain times for a certain period (T).

17. The method for database synchronization in a network element management system of claim 16, wherein said resynchronization step includes:

a step of passing to a manual synchronization step in order not to impose a load on the corresponding link, in the case that the resynchronization step is proceeded for a certain time, but synchronization is not established.

18. The method for database synchronization in a network element management system of claim 16, wherein said resynchronization step includes:

a step of waiting a resynchronization signal from said network element management system, in the case that a link error is recovered;

a step of comparing both data in said common memory and said sync-related memory when said resynchronization signal is received;

a step of transmitting changes occurred during said link error to the network element management .

19. The method for database synchronization in a network element

management system of claim 17, wherein said manual synchronization step includes:

a step of transmitting a sync-related data to said network element management system, when a link error recovery is confirmed by a network
5 operator.

a step of passing to said periodical reporting step; and

a step of maintaining the current manual state, when said link error recovery is not confirmed.

10

ABSTRACT OF THE DISCLOSURE

03469307-122299
622221-20339300

The present invention, in a DB synchronization apparatus of a transmission network system which includes a plurality of NEs and a EMS, comprises the NEs
5 each of which includes a common memory in which DB information and alarm state information are rearranged; and a sync-related memory of the same pattern as the common memory for maintaining DB identity with the EMS, and the EMS which includes a EMS sync-related memory for storing the DB and the information of the sync-related memory of the plurality of NEs, and a EMS common memory
10 corresponding to the common memory (CM) of the NE. In addition, a common memory which reflects database information and the current alarm information to the NEs, and a sync-related memory (RM) which stores data prior to a T-second period are built on the NEs, and these two memories are compared in block units to thereafter transmit only modified block data to the EMS. Accordingly, there is the
15 advantage that since synchronization is established by the comparison of the memories, an initialization execution time is very fast, and a real-time data monitoring and management is convenient.

FIG. 1
BACKGROUND ART

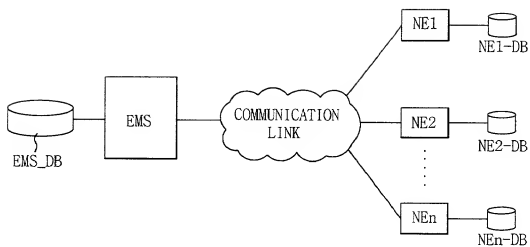


FIG. 2

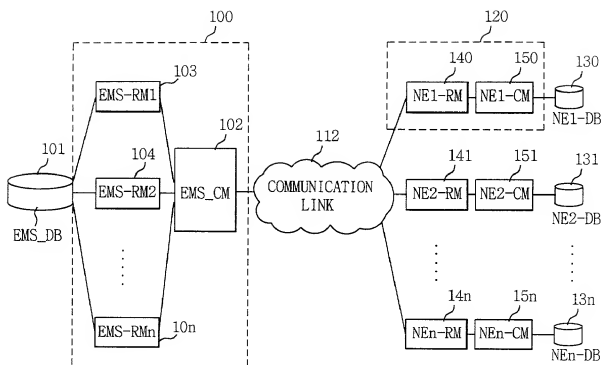


FIG. 3

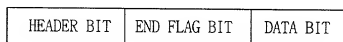
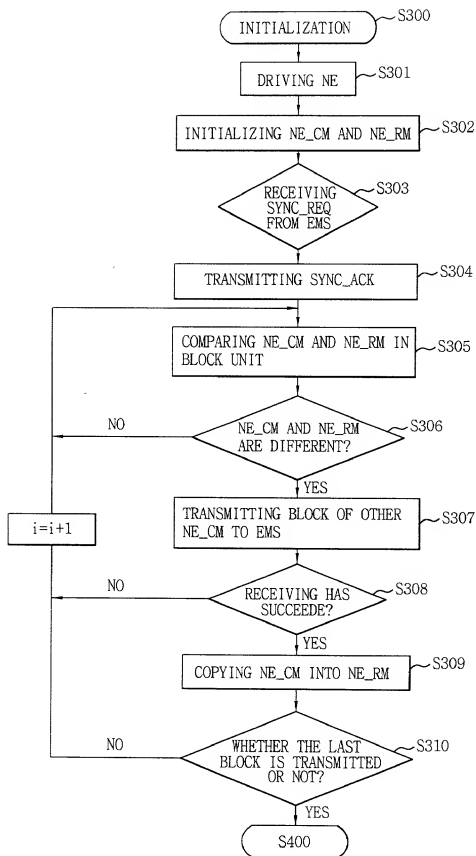
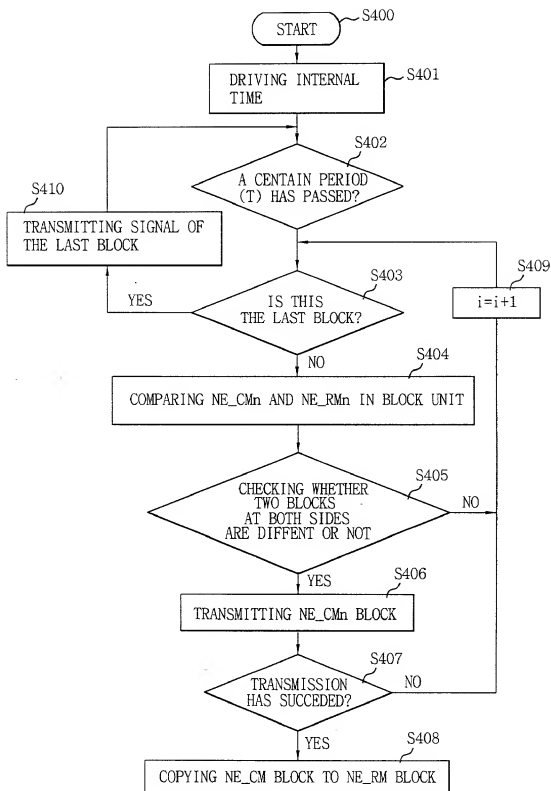


FIG. 4



09469307.122299

FIG. 5



662221-20269460

FIG. 6

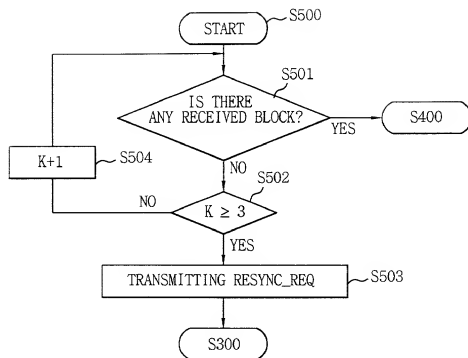
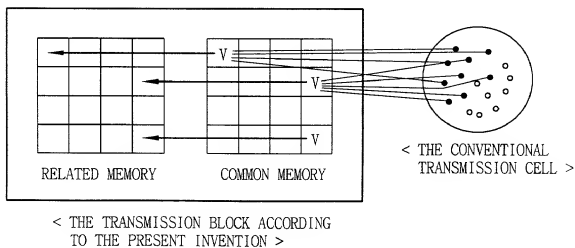


FIG. 7



Docket No.: _____

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter claimed and for which a patent is sought on the invention entitled _____
DATABASE SYNCHRONIZATION APPARATUS IN ELEMENT MANAGEMENT SYSTEM AND METHOD THEREFOR, the specification of which

[☒] is attached hereto [☐] was filed on _____ as Application Serial No. _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known to me to be material to patentability in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365 (b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s):

Number

Country

Foreign Filing Date

Month/Day/Year

58802/1998

Korea

12/26/1998

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s):

Filing Date (Month/Day/Year)

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Prior U. S. Application

or PCT Parent Number

Filing Date (Month/Day/Year)

Parent Patent Number (if applicable)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney(s) and/or agent(s): Daniel Y.J. Kim, Registration No. 36,186 and Mark L. Fleshner, Registration No. 34,596; Carl R. Wesolowski, Registration No. 40,372, John C. Eisenhart, Registration No. 38,128, and Rene A. Vazquez, Registration No. 38,647; Michael J. Cornelison, Registration No. 40,395; and Stuart I. Smith, Registration No. 42,159, all of

FLESHNER & KIM
P.O. Box 221200
Chantilly, Virginia 20153-1200

with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and all further correspondence should be addressed to them

Full name of solo or first inventor: Joong-Kyu CHOI

Inventor's signature: *Joong-Kyu CHOI*

Date: 11/12/1991

Residence: Seoul, Korea

Citizenship: Republic of Korea

Post Office Address: Mookdong Apt. 1208-408, 326, Sinjung-Dong, Yangcheon-Ku, Seoul, Korea

Full name of solo or first inventor:

Inventor's signature:

Date:

Residence:

Citizenship:

Post Office Address:

Full name of joint inventor(s):

Inventor's signature:

Date:

Residence:

Citizenship:

Post Office Address:

Full name of joint inventor(s):

Inventor's signature:

Date:

Residence:

Citizenship:

Post Office Address:
